

OVERVIEW

The projected noise impact contours calculated for this *Truckee Tahoe Airport Land Use Compatibility Plan* differ from the equivalent contours shown in the *Truckee Tahoe Airport Master Plan* adopted by the Truckee Tahoe Airport District in October 2000. This appendix examines the data on which the respective contours are based to determine the reasons for the differences. Also included here is a review of the contours produced for the *Compatibility Plan* relative to other available airport-related noise data. The results of this analysis support the legitimacy of the noise contours as presented in Chapter 3 of this document. The final section of this appendix presents four sets of future noise contours calculated using alternative forecast assumptions.

NOISE CONTOUR CALCULATION INPUT DATA

Data Sources

At most major airline and some large general aviation airports, complete records are kept regarding the number of aircraft operations, the types of aircraft, the location of flight tracks, and other factors that serve as inputs to the noise contour calculations. Also, noise monitoring data often is available which can be used to further refine the noise contours depicting existing conditions. This type of data seldom exists for airports that do not have control towers and are located outside of metropolitan areas.

At Truckee Tahoe Airport, airport staff routinely gathers data on the total number of aircraft operations and the categories of aircraft involved. Although not a 100% complete tally—some types of operations such as flight training, sailplane activity, and night operations are not fully counted—the data nevertheless provides a good indication of overall airport usage. Other input data to the noise contour calculation process—runway and flight track usage in particular—must rely upon estimates. Information supplied by airport staff, fixed base operators, and flight instructors was used together with the consultant's knowledge of how aircraft operate at other general aviation airports. A summary of the data used in the calculations is listed in Exhibit 3C.

Flight Track Locations

The flight track locations assumed for noise modeling purposes are mapped in Exhibit 3H. While an effort was made to map the locations of the major tracks as accurately as possible, the emphasis was on those tracks that affect the size and shape of the resulting noise contours. The predominant departure tracks to the west and north, for example, reflect not only the noise abatement routes followed by most aircraft, but also a range of sub-tracks to either side. For most other tracks, only a single line is shown in Exhibit 3H. Although not all aircraft follow the exact paths indicated for these other tracks, slight variations in where the modeled tracks are located would not significantly affect the shape of the contours.

To better understand the effect on the noise contours if the standard Runway 28 departure route were straight out, an additional set of noise contours was prepared. The results, compared to the contours presented in Exhibit 3G of Chapter 3, are shown in Exhibit H-1. Sub-tracks to the left and right of the primary, straight-out, track are included in this scenario.

A better representation of the locations over which aircraft fly is provided by Exhibit 3I. Rather than single-line flight tracks, this drawing shows a wide band or traffic pattern “envelope” for the airport. Even here, the envelope does not encompass everywhere aircraft fly in the vicinity of the airport. Rather it is intended to include approximately 80% of the aircraft flight routes flown at, below, or slightly above the traffic pattern altitude (1,100 feet above the airport for light aircraft and 1,600 feet for business jets and other heavy aircraft).

VALIDATION OF CURRENT-ACTIVITY NOISE CONTOURS

Sensitivity of Noise Contours to Input Data Variables

In general, the input data variables discussed above—the number and type of aircraft operations, the time of day they occur, the runway usage patterns, and flight track locations and usage—have the greatest effect on the size and shape of noise contours. Even among these variables, though, some factors have greater effect than others. This outcome is primarily due to two facets of the way noise contours are calculated.

One factor is that noise contours are cumulative measurements. They take into account all of the noise events during a specified time period—typically a year, although for Truckee Tahoe Airport the peak season was also evaluated. Evening (7:00 to 10:00 p.m.) and night (10:00 p.m. to 7:00 a.m.) events are weighted more heavily than daytime activity because people tend to be more sensitive to noise during these hours.

The second critical factor is that noise is measured on a logarithmic scale. The loudness of individual aircraft overflights and the quiet of the intervals between operations are both taken into account. It is beyond the intent of this appendix to describe in greater detail the mathematics of noise measurement. The key point that needs to be made, though, is that a small number of operations by noisy aircraft can influence noise contours more than a large number of operations by much quieter aircraft. This is particularly true when the loud events occur at night.

Other, non-aircraft-related noise calculation input variables such as terrain, airport elevation, air temperature, and humidity, normally produce only minimal effects on noise contours. Of these factors, terrain can have the greatest influence if ground levels within the noise contour area are significantly higher or lower than the airport elevation. Topographic data was included in calculation of the noise contours depicted in Chapter 3 of this *Compatibility Plan*. For comparative purposes, a test was done without the topographic data. In most locations, very little difference in the contours resulted. This outcome makes sense when it is recognized that, despite the high terrain around the Truckee Tahoe Airport, elevations within most of the area encompassed by the noise contours vary by less than 100 feet from that of the airport.

An airport’s elevation and typical air temperatures can have an influence on noise contours because these factors affect aircraft performance. In general, high altitude and/or high temperatures cause aircraft to climb more slowly on takeoff. The result tends to be an elongation of the noise contours. The

noise contour calculations for Truckee Tahoe Airport took into account the airport's elevation and average annual temperature. A test using an average summer temperature resulted in a fraction of a decibel increase along the primary flight paths and a similarly insignificant reduction lateral to the runway. Humidity affects noise propagation, but is not explicitly considered in the Truckee Tahoe Airport noise calculations.

Calculated versus Measured Noise Levels

Except at airports where permanent noise monitoring equipment is installed and extensive data on aircraft operations is gathered, the input data estimations that are unavoidable in noise contour calculations result in an inherent degree of imprecision. For airports such as Truckee Tahoe Airport, an accuracy of ± 3 dBA is common for contours depicting current noise levels. When the added uncertainty of forecasts is included, the precision of future-year contours is even less.

No noise monitoring was conducted as part of the present study. However, a limited amount of noise measurement data was summarized in recent environmental documents for three nearby land development projects. This data has been reviewed and compared with the calculated current average annual day noise contours depicted in Exhibit 3D of the *Compatibility Plan*. Exhibit H-1 illustrates this comparison.

- > **Gray's Crossing Specific Plan** (Bollard & Brennan, Inc.; November 17-20, 1999 noise measurements)—Noise at three of the measurement sites (1, 2, 4, and 5) is clearly dominated by I-80 and/or Highway 89/267 noise. No effort was made in the study to distinguish among noise sources. Site 3 is far enough from major roads and close enough to one of the departure flight tracks that aircraft noise could be a factor. The measured noise level was approximately 50 dB CNEL. A 50 dB CNEL contour was not calculated for the *Compatibility Plan*, but judging from the other contours, the airport-related noise level at Site 3 would be roughly equal to that amount.
- > **Hopkins Ranch Project** (Bollard & Brennan, Inc.; July 11-15, 2001 noise measurements)—The one site continuously monitored (Site A) was adjacent to Highway 267 about on the extended centerline of Runway 1-19. The study showed daily Ldn values ranging between 61.8 and 63.4 dB for full days. Again, no distinction is made between highway and aircraft noise sources. The contours in Exhibit H-2 indicate about 57 dB CNEL for present airport activity. This noise level is consistent with the overall noise measurement.
- > **Ponderosa Pines Residential Development** (Bollard & Brennan, Inc.; September 7-10, 2001 noise measurements)—Measurements at the middle of the site found overall CNEL values ranging between 51.8 and 58.5 dB. Aircraft-related noise was calculated as ranging between 50.0 and 53.7 dB CNEL for the monitoring days. The study concluded that the actual aircraft-related noise levels at the site could be somewhat higher, but no more than 55 dB CNEL. The *Compatibility Plan* contours show 55 dB CNEL at this point.

On the whole, each of these independent noise analyses strongly validate the accuracy of the present-day noise contours as calculated for the *Compatibility Plan*.

FUTURE NOISE IMPACTS

Comparison with Airport Master Plan Noise Contours

In October 2000, the Truckee Tahoe Airport District adopted a new *Truckee Tahoe Airport Master Plan*. Projected noise contours for 2020 were presented in the plan (see AMP Exhibit A2). A comparison between the AMP noise contours and the long-range noise impacts calculated for the present *Compatibility Plan* show that the AMP contours are larger in nearly all locations. The two sets of contours are depicted here as Exhibit H-3.

In an effort to identify the reasons for these differences, additional noise modeling data was obtained from the *Master Plan* consultants (Coffman Associates). Several important findings resulted from this review.

One notable distinction is that the long-term activity forecasts in the *Compatibility Plan* are roughly double those in the *Airport Master Plan*: 120,000 versus 61,600 total annual aircraft operations. In order to promote a high degree of land use compatibility, the *Compatibility Plan* forecasts extend to an indefinite time period assumed to be well beyond the 2020 horizon of the *Master Plan*. Also, the *Compatibility Plan* includes an assumed 20,000 aircraft operations on a future fourth runway parallel to the existing primary runway (both plans include a third runway for sailplanes).

All other factors being equal, this 2-to-1 ratio should result in the *Compatibility Plan* contours being 3 dB larger than the contours in the *Master Plan*. Since the actual difference between the contours is in the opposite direction, the explanation for the difference must rest elsewhere. As discussed earlier, including even a relatively small number of noisy aircraft in the fleet mix can have a substantial effect on the contours. Exhibit H-4 illustrates the major difference between the noise footprint (a single landing and takeoff) of the old-style business jets versus those of the 1990s. The latter aircraft are, in turn, much noisier than equivalent aircraft being manufactured today. Particularly noticeable is the extent to which newer aircraft have become quieter on takeoff.

The effect of including the old-style business jets in the fleet mix at Truckee Tahoe Airport can further be seen in Exhibit H-5. The map depicts the contours generated solely by 600 annual operations of a Lear 25 with no other aircraft in the mix. This aircraft type and future activity level are included in the fleet mix used in calculating in the *Master Plan* 2020 noise contours. For comparison, Exhibit H-5 also shows the projected future annual average day noise impacts as calculated for the *Compatibility Plan* (the contours in Exhibit 3F). As can be seen, the noise contours generated by the Lear 25 extend farther to the northwest—the predominant takeoff direction—than the *Compatibility Plan* contours representing all aircraft operations. The *Compatibility Plan* anticipates that old aircraft such as these will no longer be in operation 20+ years hence. Few of the 1990s era jets are expected to be in use by then either.

Alternative Assumptions for Future Noise Contours

During review of the draft plan, the issue of what input assumptions should be used for future noise contours continued to be discussed. To assess the implications of alternative assumptions, noise contours were calculated for four other scenarios and the results compared to the contours included in Exhibits 3G and 3I of the plan. These alternative scenarios reflect various combinations of assumptions concerning the future total annual operations volume, the presence of older style business jets, and whether a fourth runway would be built. All scenarios assume an unpaved third runway, primarily for

sailplane use, parallel to the crosswind runway. The fourth runway would parallel the primary runway on its northeast side.

The specific assumptions included in the four scenarios examined are as follows:

- Exhibit H-6: 120,000 total annual operations, some old jets, four runways
- Exhibit H-7: 100,000 total annual operations, no old jets, three runways
- Exhibit H-8: 60,000 total annual operations, some old jets, four runways
- Exhibit H-9: 60,000 total annual operations, some old jets, three runways.

Keeping the old jets in the fleet mix expands the noise contours to the northwest by up to 2 dB CNEL with the greatest change occurring closest to the runway (Exhibit H-6). Removal of the parallel runway and the 20,000 operations associated with it affects the contours primarily to the northeast where the traffic pattern for this runway would be (Exhibit H-7). Cutting the activity projection back to 60,000 annual operations on four runways, but including some old jets in the mix, reduces the contours all around and particularly in areas not greatly affected by jet overflights (Exhibit H-8). The scenario with 60,000 operations on three runways (Exhibit H-9) is similar to the four-runway scenario, but has comparatively more reduction on the north and less on the south.

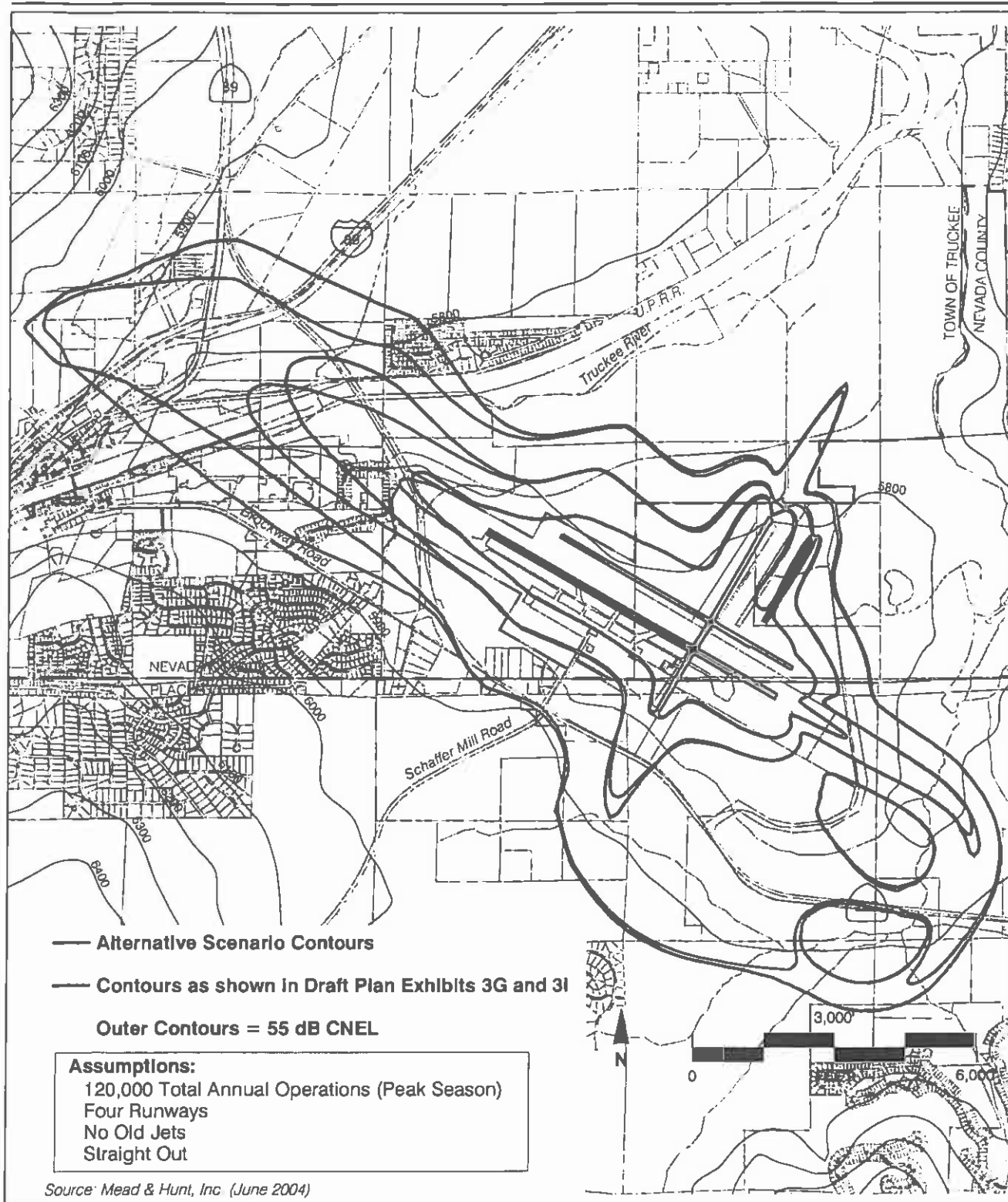


Exhibit H-1

Straight-Out Scenario

Truckee Tahoe Airport

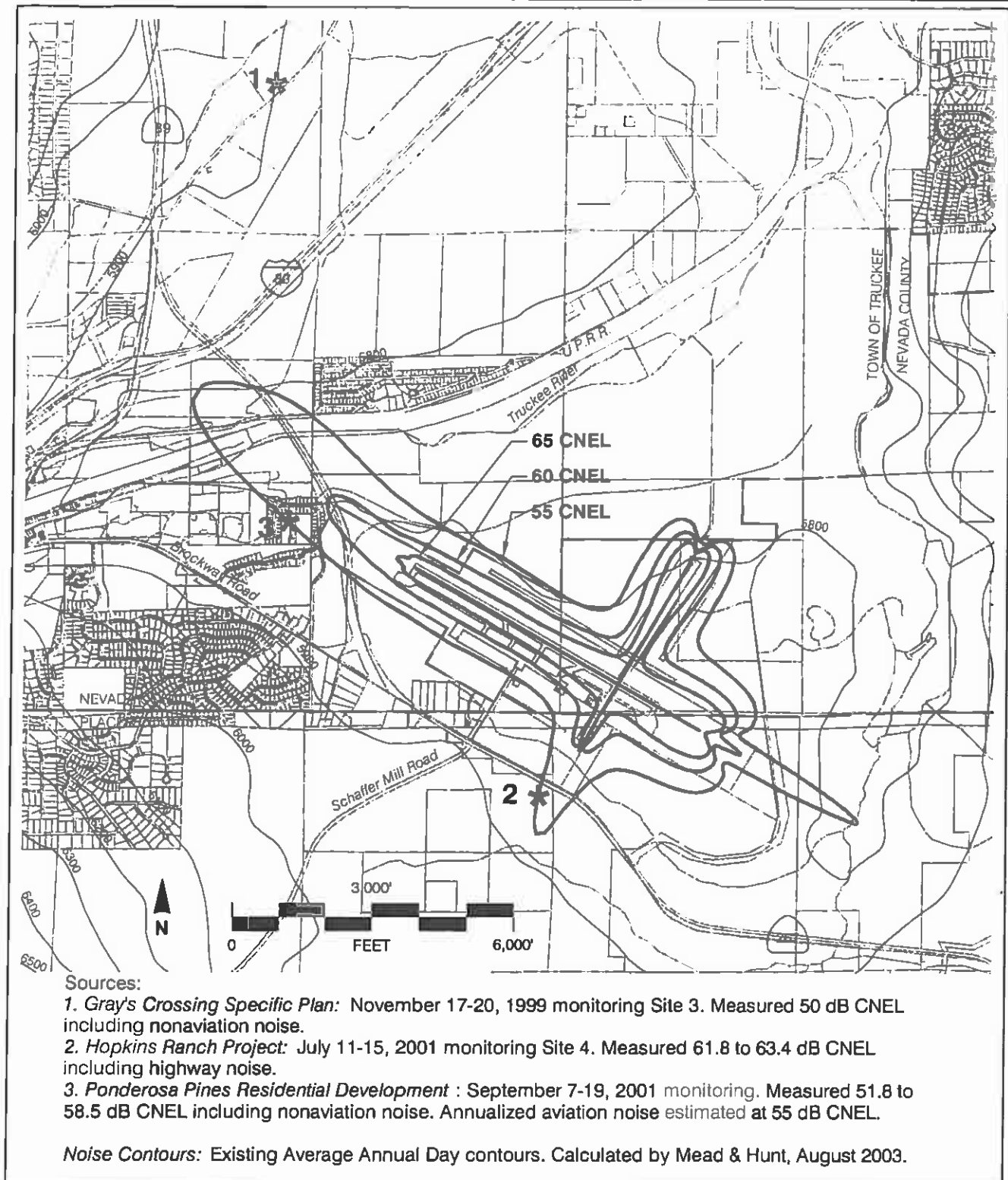


Exhibit H-2

Calculated versus Measured Existing Noise Levels

Truckee Tahoe Airport

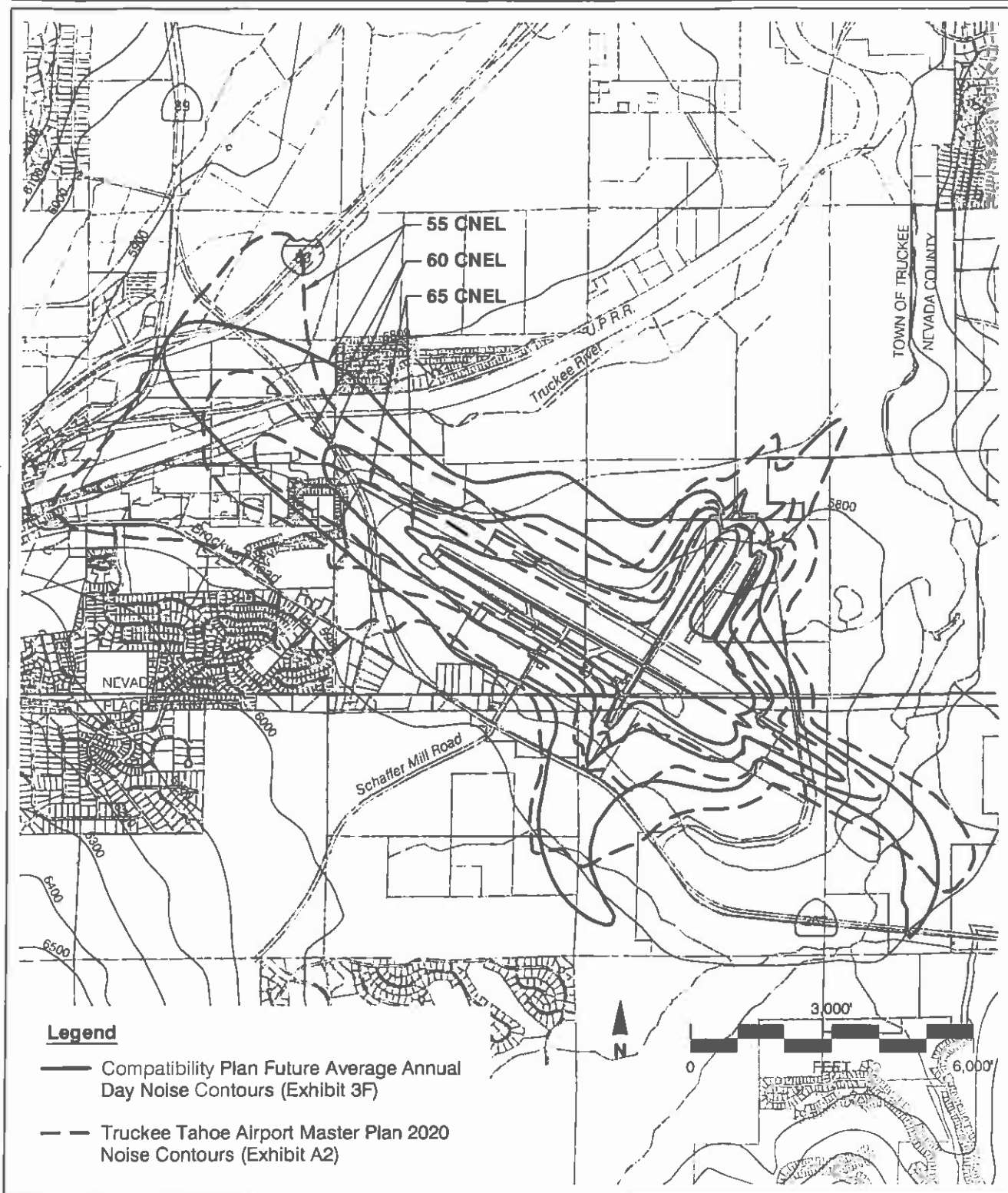


Exhibit H-3

Compatibility Plan versus AMP Noise Contour Comparison

Truckee Tahoe Airport

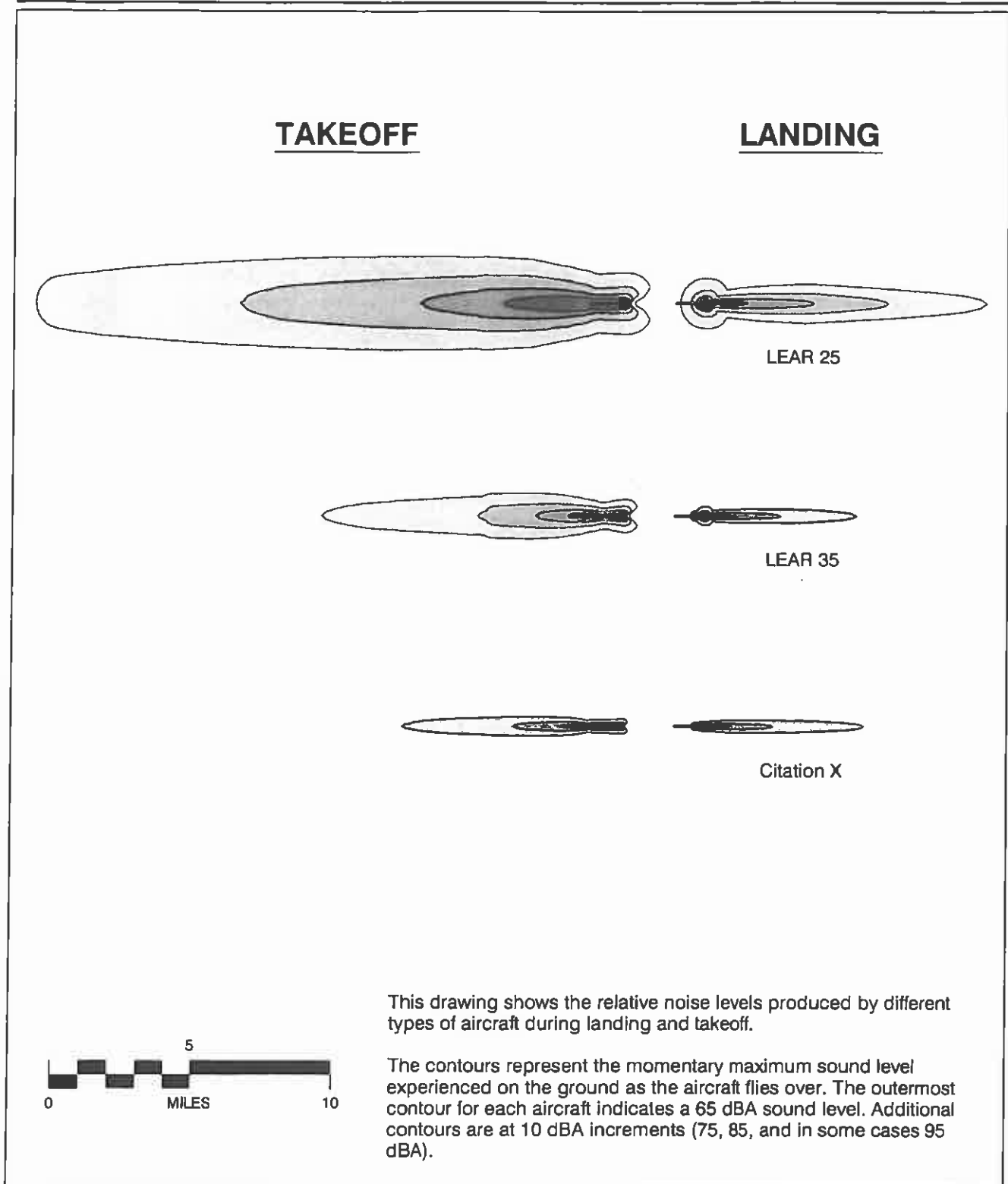


Exhibit H-4

Aircraft Noise Footprints

Truckee Tahoe Airport

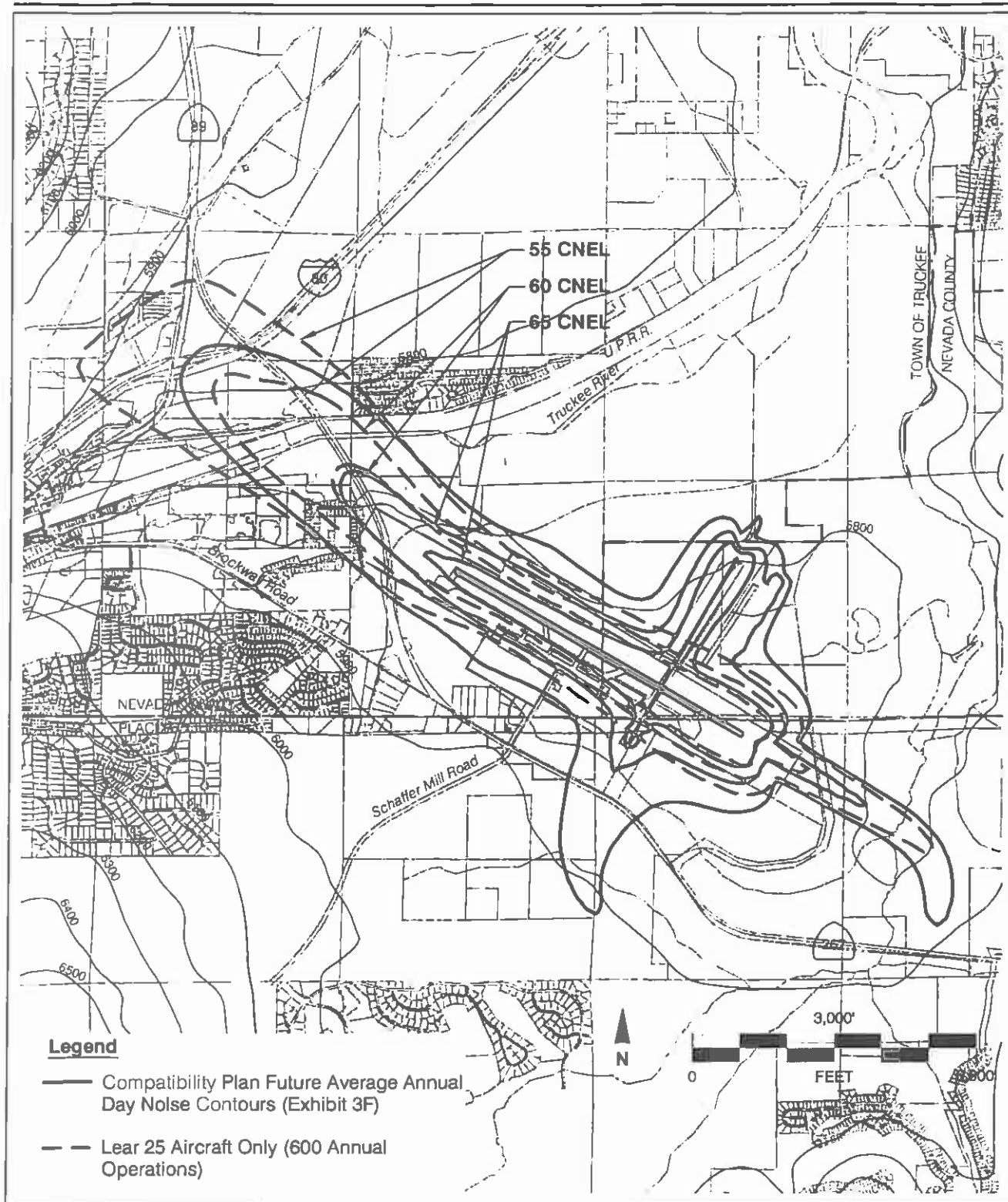


Exhibit H-5

Lear 25 Aircraft Noise Contour: Average Annual Day

Truckee Tahoe Airport

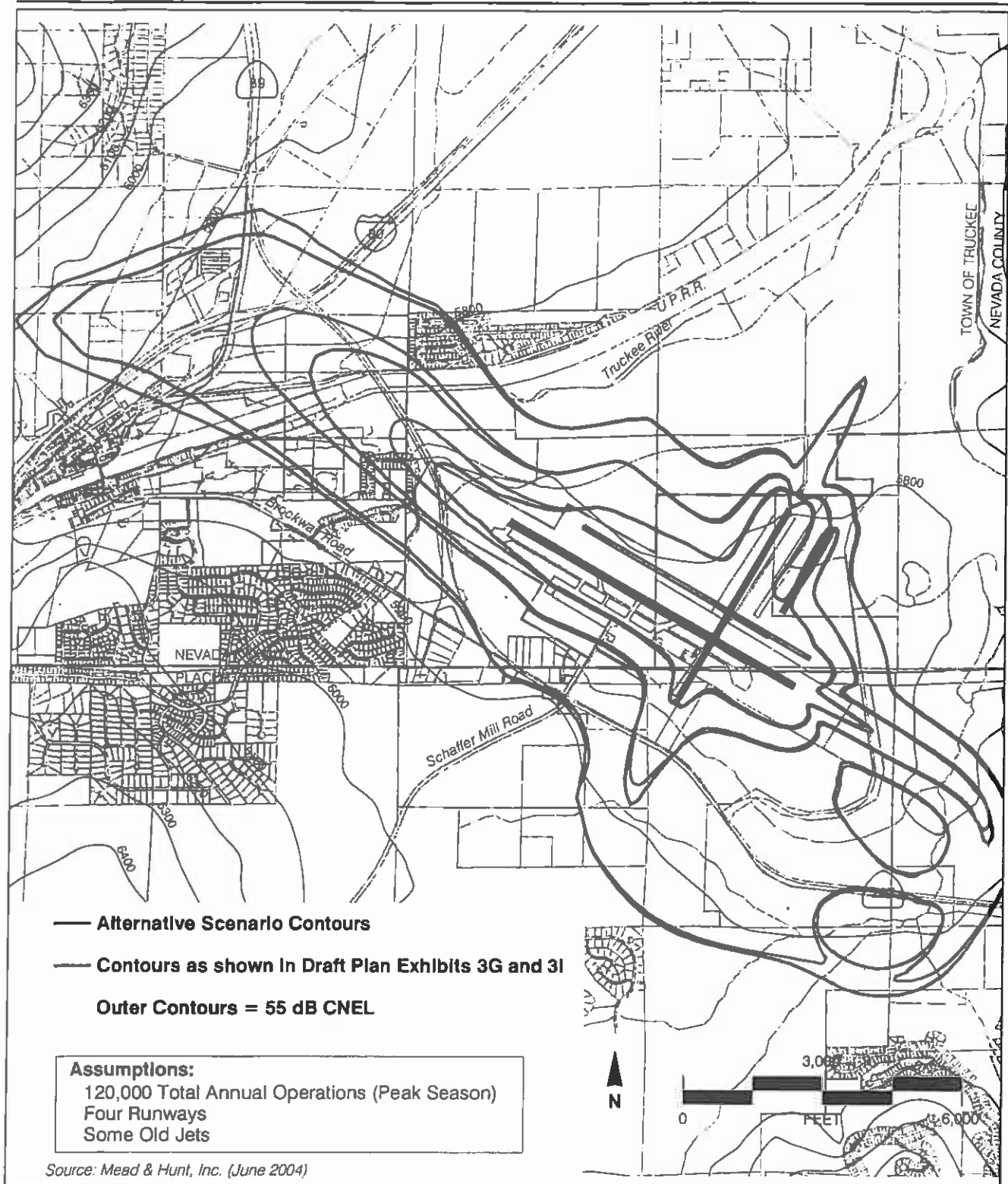


Exhibit H-6

Scenario With Old Jets in Mix

Truckee Tahoe Airport

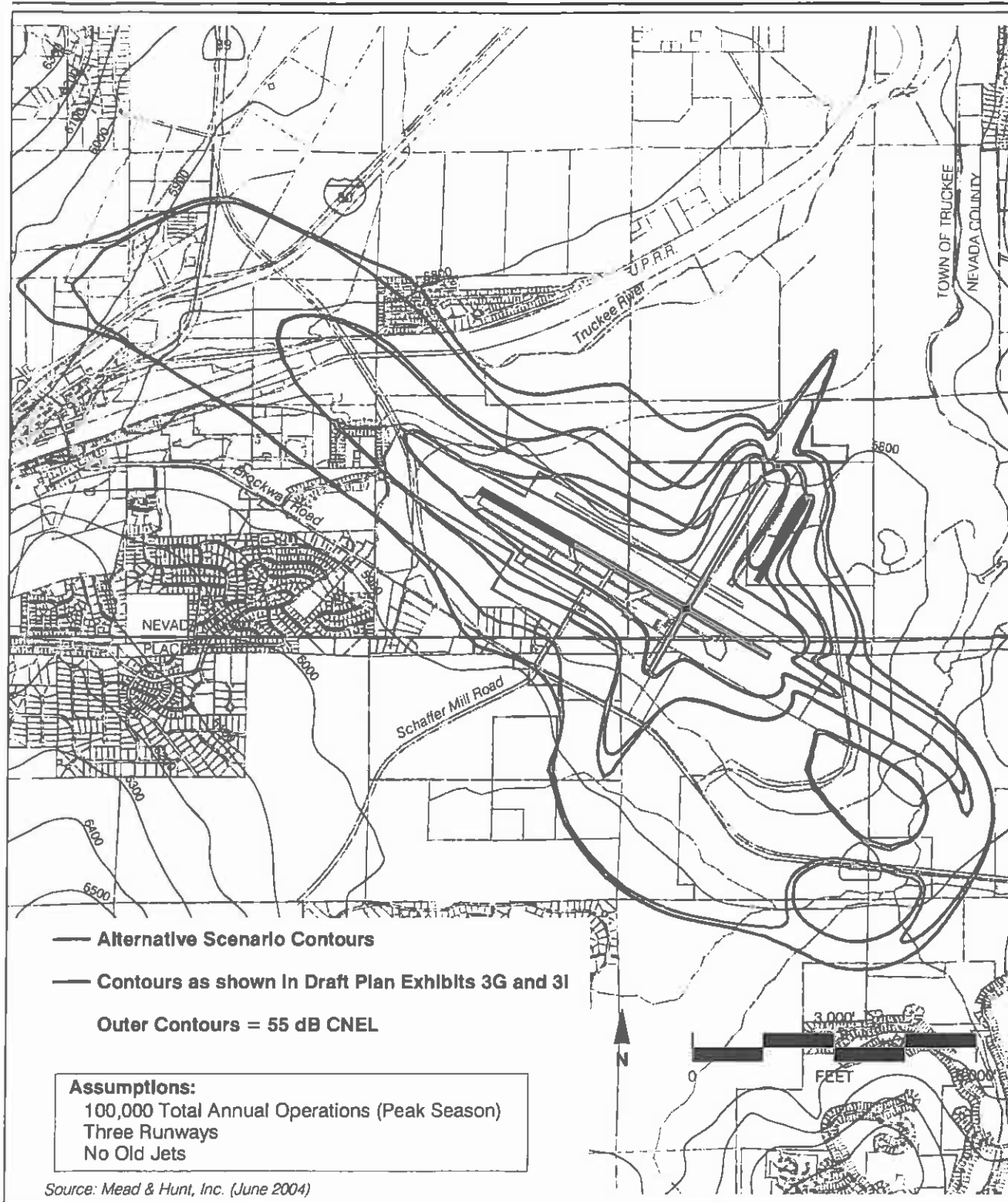


Exhibit H-7

Three Runway Scenario

Truckee Tahoe Airport

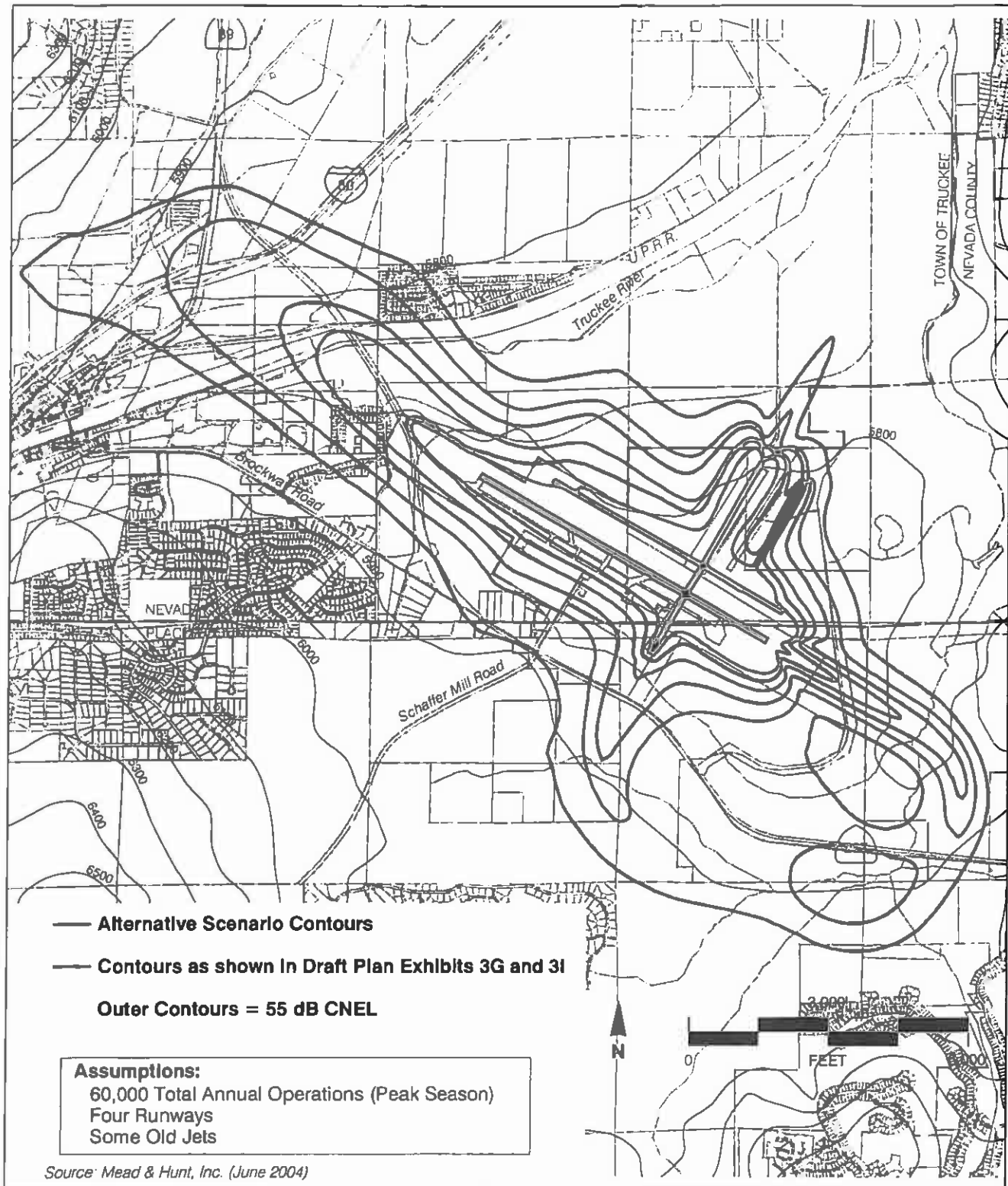


Exhibit H-8

Reduced Activity Scenario

Truckee Tahoe Airport

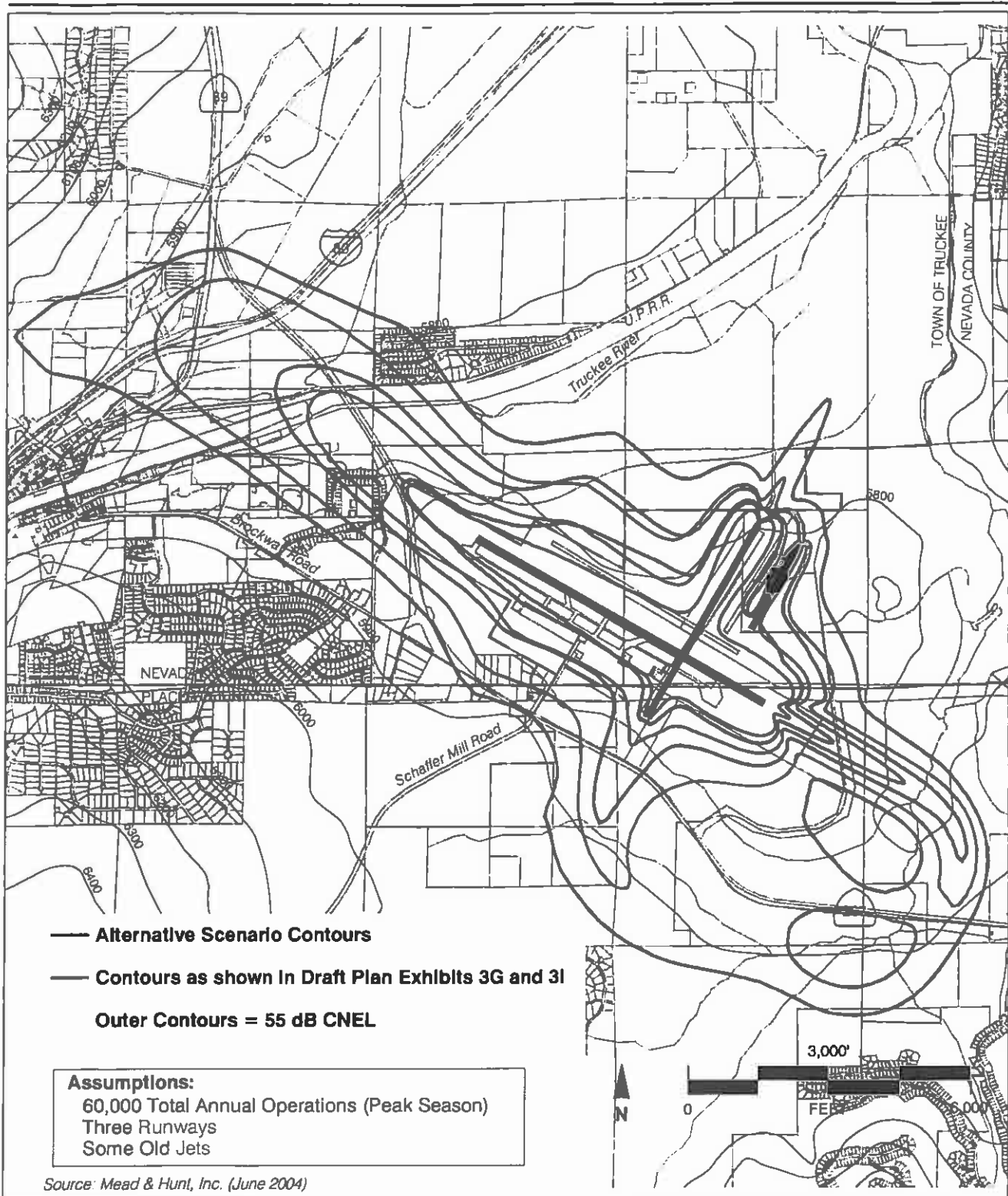


Exhibit H-9

Reduced Activity, Three Runway Scenario

Truckee Tahoe Airport